Claim Listing

24. (Currently amended) A miniaturized terahertz radiation source based on the Smith-Purcell effect, comprising:

a field emitter;

an electrostatic lens;

a beam deflector;

a grating of metal; and

~~a second~~ an anode;

wherein the field emitter, the electrostatic lens, the beam deflector, the grating of metal and the ~~second~~ anode are integrated on a semiconductor chip using one of additive and nanolithographic methods,

and wherein from a focused electron source, a high-energy bundle of electrons is transmitted at a defined distance over a reflection diffraction grating having transversely disposed grating rods so that in response to an image charge oscillating within a profile of the reflection diffraction grating an electromagnetic wave of a wavelength is emitted and is adjustable as a function of a periodicity of lines and of electron velocity.

25. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein the electron source is a wire constructed using additive nanolithography out of readily conductive material having stabilizing series resistance,

and wherein the wire is positioned using computer-controlled deposition

lithography in at least one of a straight design and a curved design to end freely over a surface of a conductor path structure for any electrical terminals and connections in any tips of the field emitter.

26. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein the electron source has a punctiform design and a material, having a low work function and emits electrons at least in response to relatively low voltages, and is deposited on any tips of the field emitter using additive nanolithography.

27. (Currently amended) The miniaturized terahertz radiation source of claim 24, wherein the field emitter, the electrostatic lens, the beam deflector, the grating of metal, and the ~~second~~ anode, are encapsulated in a vacuum-tight manner by a covering chip.

28. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein the beam deflector is configured to deflect an electron beam in a horizontal direction and a vertical direction, the grating of metal is configured to have an underlaid reflector constructed in integrated fashion, using mix-match technology, on prefabricated metal conductor connection structures having integrated grating structures, on a layer of silicon dioxide of a substrate of silicon, having a THz reflector base in a grating region, all being an imperviously encapsulated structure so as to be transparent to terahertz radiation, and

the electron beam emerging from the electron source is configured to be focused through an electrostatic lens in the form of a miniaturized wire lenses and is configured to be guided and positioned by integrated deflecting plates in relation to a position of the

reflection diffraction grating, and

a terahertz radiation is configured to be produceable to have an intensity and wavelength which are variable and selectable.

29. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein to accelerate the electrons behind the electron source, an accelerator grid in form of a free-standing electrode having at least one of two cylindrical rods and a standing wire ring is positioned behind the field electron source; and

any accelerated electrons arrive in one of round multipole lenses and cylindrical lenses of an electrostatic lens configured subsequent to the accelerator grid, and the electron beam propagates without being deflected over a subsequent reflection diffraction grating at a homogeneous distance to a surface.

30. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein the reflection diffraction grating, having a length of approximately 1 mm to 1 cm and grating periods of approximately 0.5 to 10 μm, depending on a wavelength of a terahertz radiation to be emitted, is positioned subsequent to the electrostatic lens and the beam deflector which are implemented using additive nanolithography on a metal structure produced using one of electron-beam and optical lithography.

31. (Previously added) The miniaturized terahertz radiation source of claim 24, further comprising: a plurality of electrically isolated diffraction gratings positioned side-by-side in a gratings of metal manner, the plurality of electrically isolated diffraction gratings being configured to be activated in response to selection of various sources for

selecting different emitted wavelengths.

32. (Previously added) The miniaturized terahertz radiation source of claim 28, further comprising ionic getter materials, capable of being activated by an electrode, applied to the semiconductor chip near to a Smith-Purcell element, to produce and maintain a required vacuum in the encapsulated structure.

33. (Currently amended) The miniaturized terahertz radiation source of claim 25, further comprising a controllable voltage source connected via at least one of an electrical terminals and connections to the electron source to stabilize radiation from the electron source;

and wherein the electron beam exiting any tips of the field emitter is collected on an electrode of the ~~second~~ anode.

34. (Currently amended) The miniaturized terahertz radiation source of claim 24, wherein to precisely adjust the wavelength and/or generate a desired frequency spectrum, a voltage is applied between an earth electrode of the electrostatic lens and an electrode acting as the ~~second~~ anode to alter the electron velocity along a grating.

35. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein the miniaturized terahertz radiation source is covered by a membrane window etched using a silicon membrane technique and is configured to be evacuated in a vacuum system prior to a bonding operation to a pressure withing a range of 10^{-4} Torr, which suffices for an average free path length of one millimeter; and

further comprising at least one chamber constructed in the vacuum system using

thermal bonding as to be able to be at least one of encapsulated and sealed without short-circuiting a voltage supply.

36. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein two membrane windows are positioned next to one another in a covering chip for two chambers; and

in one of the two membrane windows a getter pump is set in operation by a one-time activation in response to current flow, and the entire volume of the two chambers receives a required operating pressure.

37. (Previously added) The miniaturized terahertz radiation source of claim 36, wherein the two membrane windows in the covering chip are treated with additionally applied layers to reduce reflection.

38. (Previously added) The miniaturized terahertz radiation source of claim 24, further comprising a terahertz radiation reflector configure underneath a grating region, the terahertz radiation reflector being configured as one of a metal layer and an arrangement of grating rods, and having a defined spacing of a suitable period, having at least one of a magnetic and non-magnetic material to strengthen an intensity of emitted terahertz radiation.

39. (Previously added) The miniaturized terahertz radiation source of claim 38, wherein an intensity fo the radiation source is variable in response to beam guidance over the grating of metal at a defined distance; the radiated intensity is configured to be modulated in response to an application of an alternating current voltage to a deflecting

element, by employing an additional deflecting element before the grating of metal.

40. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein the radiation source is configured to generate terahertz radiation as modulated radiation for spectroscopic purposes, and wherein the modulated radiation is generatable by modulating an extraction voltage at any tips of the field emitter.

41. (Previously added) The miniaturized terahertz radiation source of claim 24, further comprising a monochromator on an overlying surface in form of one of a nanometer structure and a micrometer structure that acts on a region; and wherein terahertz radiation is configured generatable with a different wavelength and exits the radiation source in different directions.

42. (Currently amended) The miniaturized terahertz radiation source of claim 24, wherein an electrical field is applied between the electrostatic lens for focusing and an end of the grating of metal, an additional electrode of the ~~second~~ anode is positioned at the end of the grating of metal which, through an applied voltage, either accelerates or decelerates flying electrons.

43. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein the grating of metal is subdivided into regions which are disposed in parallel to a beam direction and in which different grating constants are implemented, and wherein a lateral deflecting element for at least one of beam guidance and wavelength selection is mounted around grating regions, and/or groups of field emitters are selectively driven.

44. (Currently amended) The miniaturized terahertz radiation source of claim 24,

wherein the grating of metal varies in its grating constant transversely to the beam direction so that deflection fields or deflecting plates, which surround the grating of metal all around, are positioned as beam deflectors, such that a beam guidance over the grating of metal is variable in such a way that one region having a different grating constant is selected for emitting a wavelength of terahertz radiation and if the grating of metal has a variable grating constant then the wavelength of the ~~terahert~~ terahertz radiation is continuously adjustable.

45. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein an electrostatic plate is transparent to the terahertz radiation and is positioned to provide intensity control below and above the grating of metal, and enables a position of the electron beam to be varied in an entire grating region.

46. (Previously added) The miniaturized terahertz radiation source of claim 24, wherein the radiation source is designed as a component that is available in modular form and is usable in any spatial situation.